ENPHASYS Annual Review

The ENPHASYS Team

Stan Morain, PI

NASA Public Health Program Review ◆ September 14-16, 2011 ◆ Santa Fe, NM

Project Status

- No-cost extension until March 2012
- Remaining tasks
  - CMAQ O_3 & Aerosol Assessments
  - Final Benchmark Report
  - Book: *Environmental Tracking for Public Health Surveillance*

Project Goals

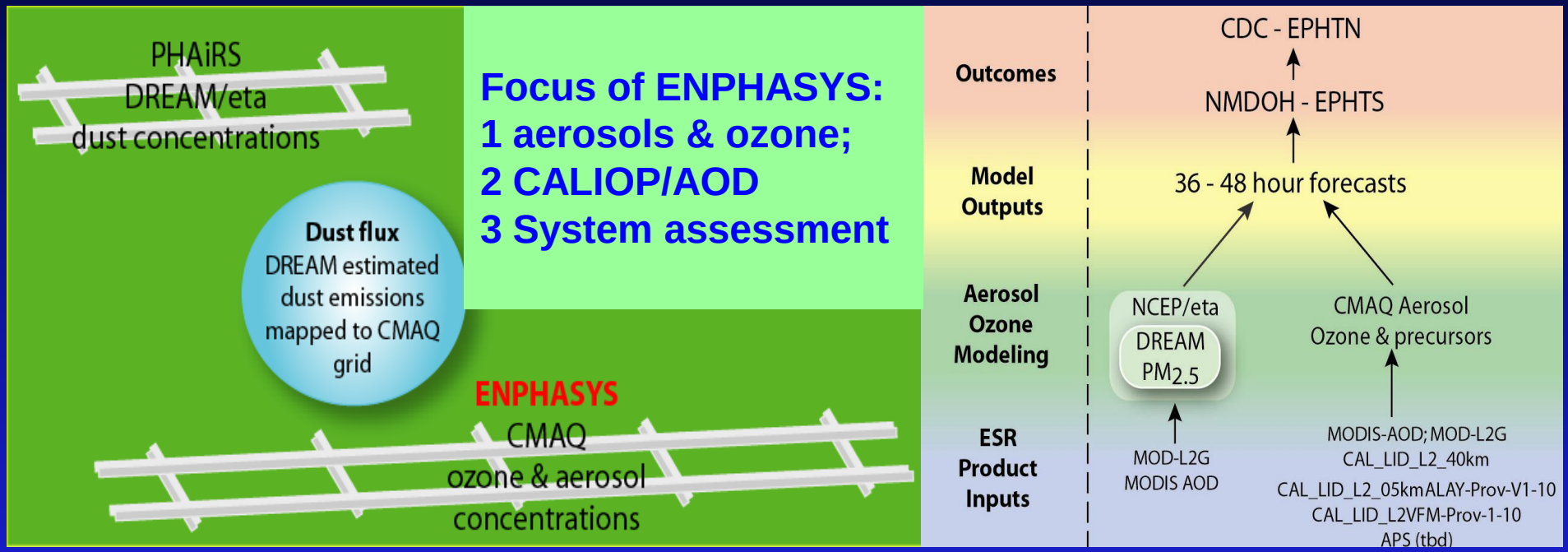
Primary Goals:

- Update dust sources to refresh MCD12 Land Cover
- Enhance EPHTS to include dust & aerosol products
- Add DREAM dust loadings into CMAQ to separate atmospheric & anthropogenic components
- Assess CMAQ aerosol patterns for events & concentrations
- Evaluate CALIOP profiles for validating AOD observations

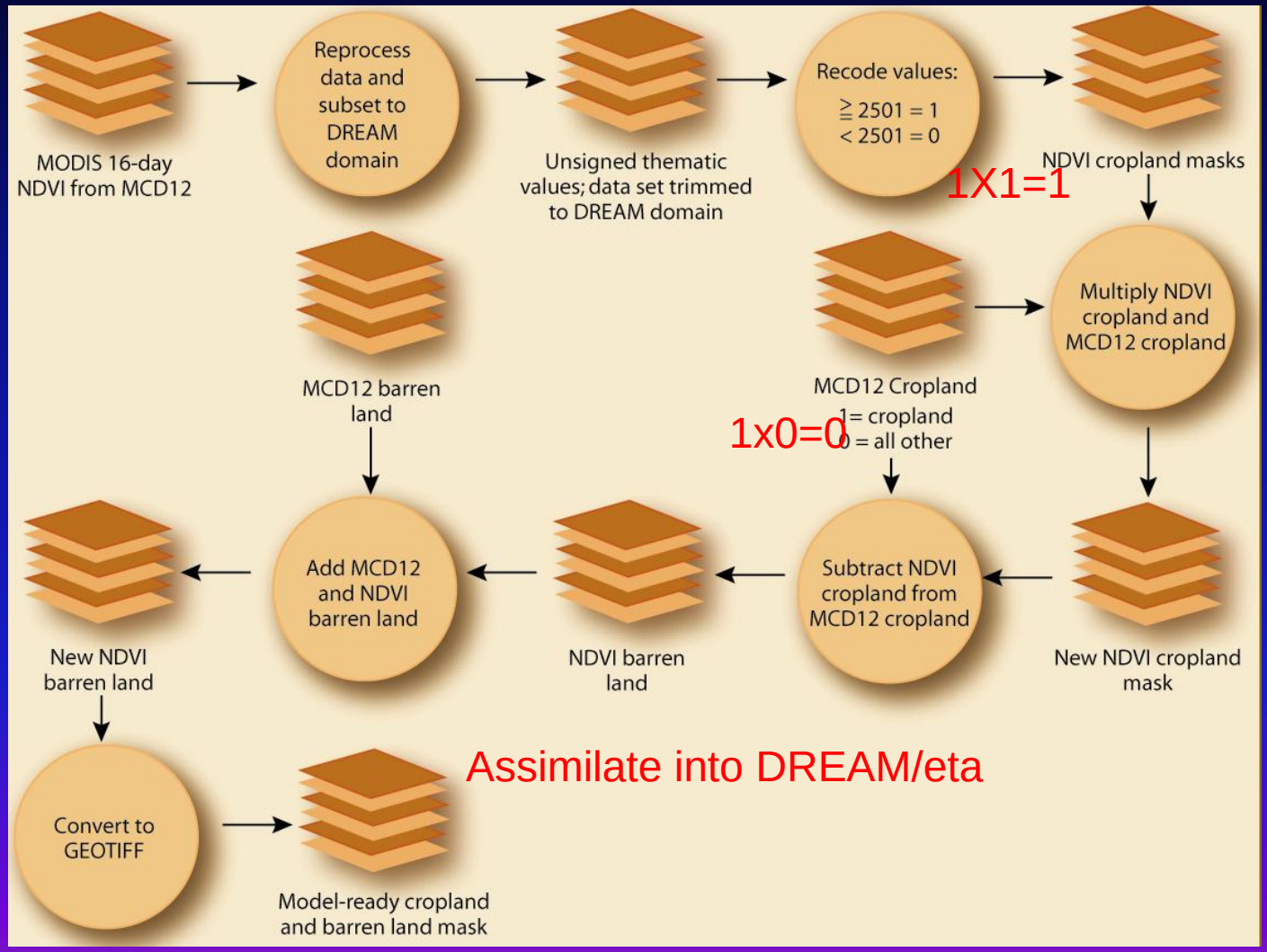
Collateral Goals:

- Add DREAM/eta 7.5km, 4-bin version to 17km, 4-bin version
- Experiment with DREAM/eta 50, 17 & 7.5km, 4- & 8-bin versions & evaluate model configurations
- Inventory & evaluate CALIOP & AOD over SW US region
- Design & experiment with potential health applications

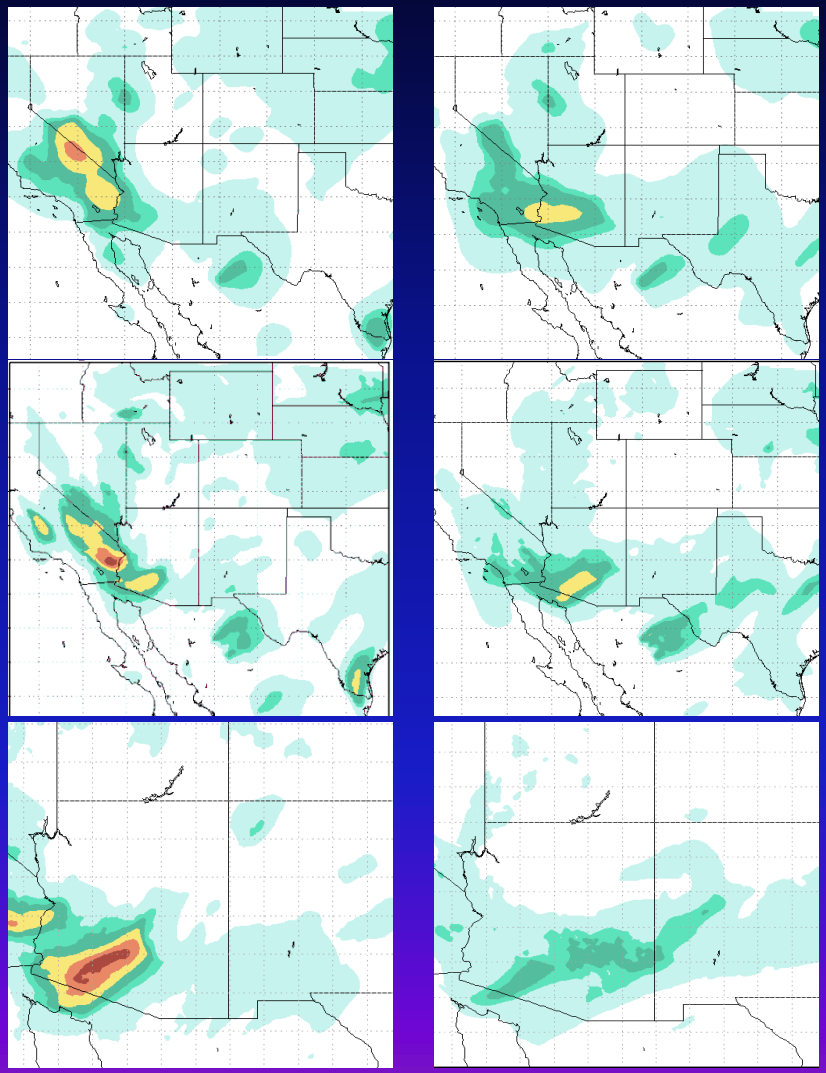
Project Strategy



Refresh Dust Source Geography Biweekly



Forecasted DREAM/eta Dust Loads for 3 Model Resolutions on 22Dec09



Hr. 24 (left); Hr. 33 (right)

50km, 8-bin

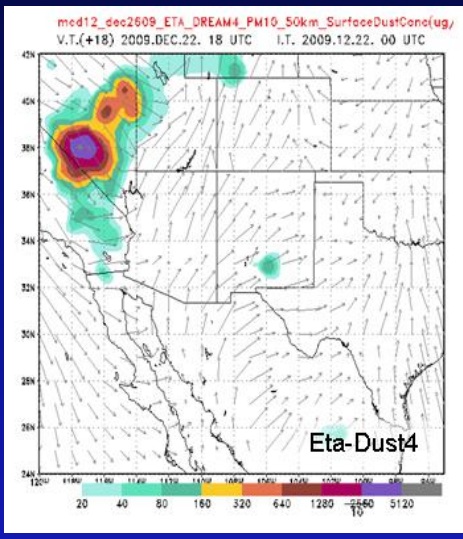
17km, 8-bin

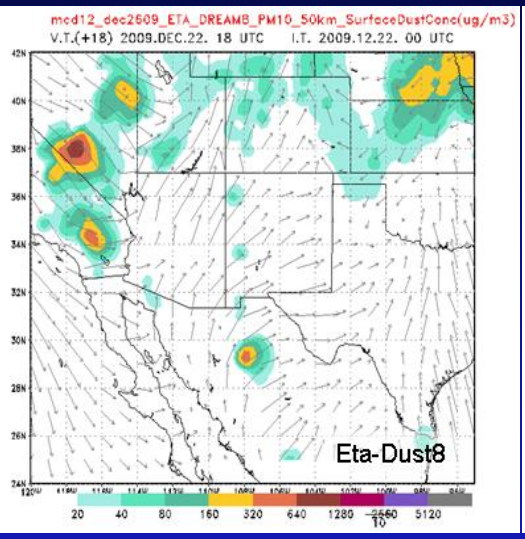
22Dec09 was the date of A “killer dust storm

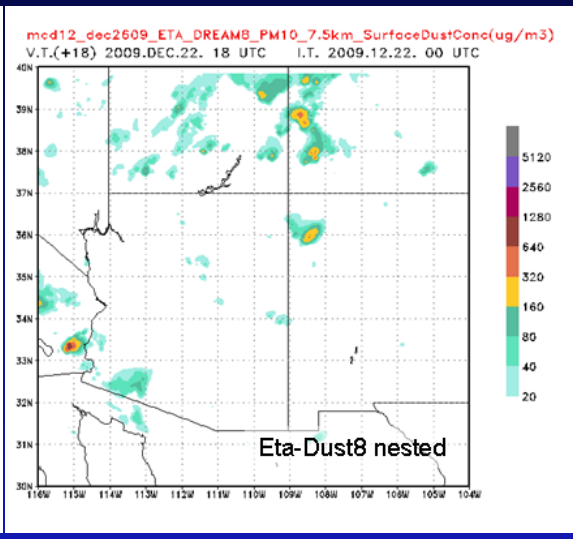
7.5km, 8-bin

Model Comparisons for $PM_{2.5}$ & PM_{10} (all for 22Dec09 18UTC)

1 2 3 4







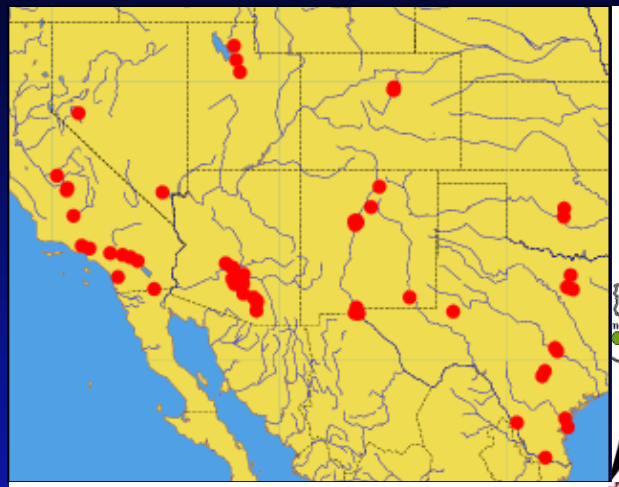
Effective radius (μm)		
particle	D4	D8
1	0.73	0.15
2	6.10	0.25
3	18.0	0.47
4	38.0	0.80
5	-	1.36
6	-	2.29
7	-	3.93
8	-	7.24

Derivation of $PM_{2.5}$ and PM_{10}
D4: p1~$PM_{2.5}$; p1+p2~PM_{10}
D8: p1+p2+p3+p4+p5 ~ $PM_{2.5}$

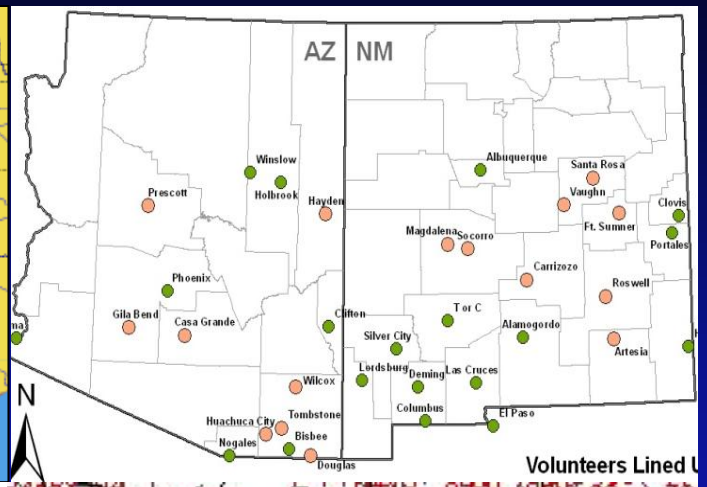
Surface dust concentrations (μg/m³): (#1) low resolution grid (0.3 , 50km, 4-bin); (#2) 50km grid, 8-bin; (#3) high resolution grid (0.05 , 7.5km, 8-bin; and (#4) effective radii for 4 & 8 bin models. Derivation of $PM_{2.5}$ & PM_{10} are for the 4-bin version; and $PM_{2.5}$ for the 8-bin version..

Air Quality Observation Networks for Verification and Validation

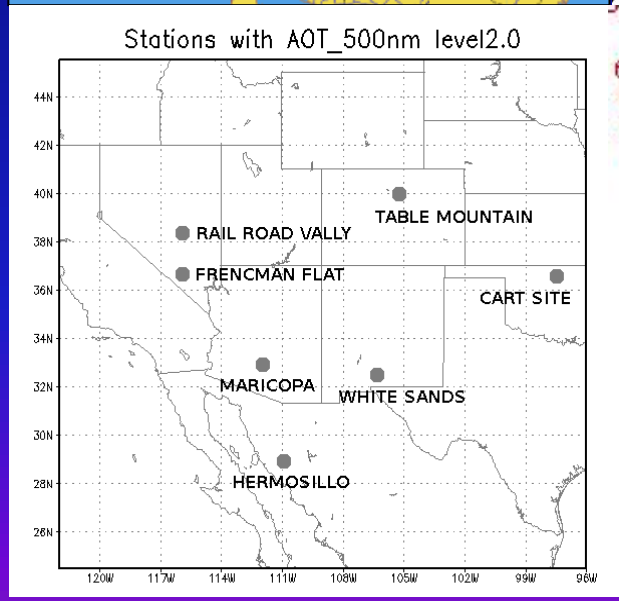
AIRNow Stations



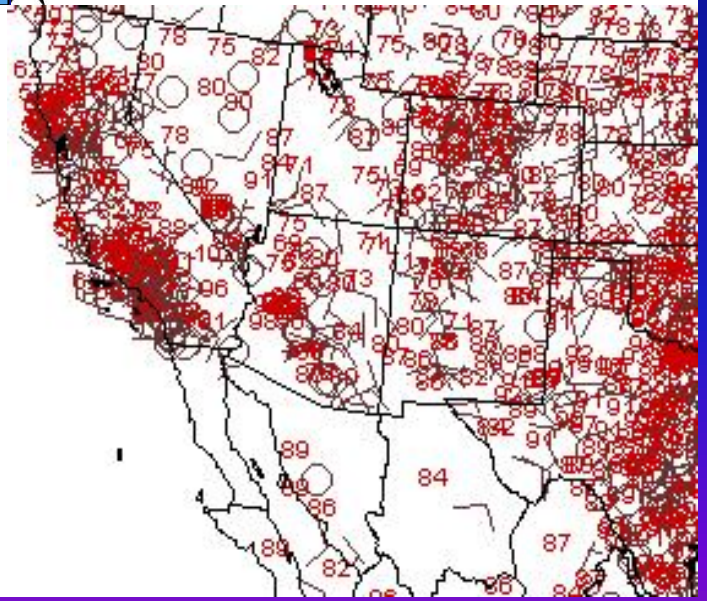
Human Observers



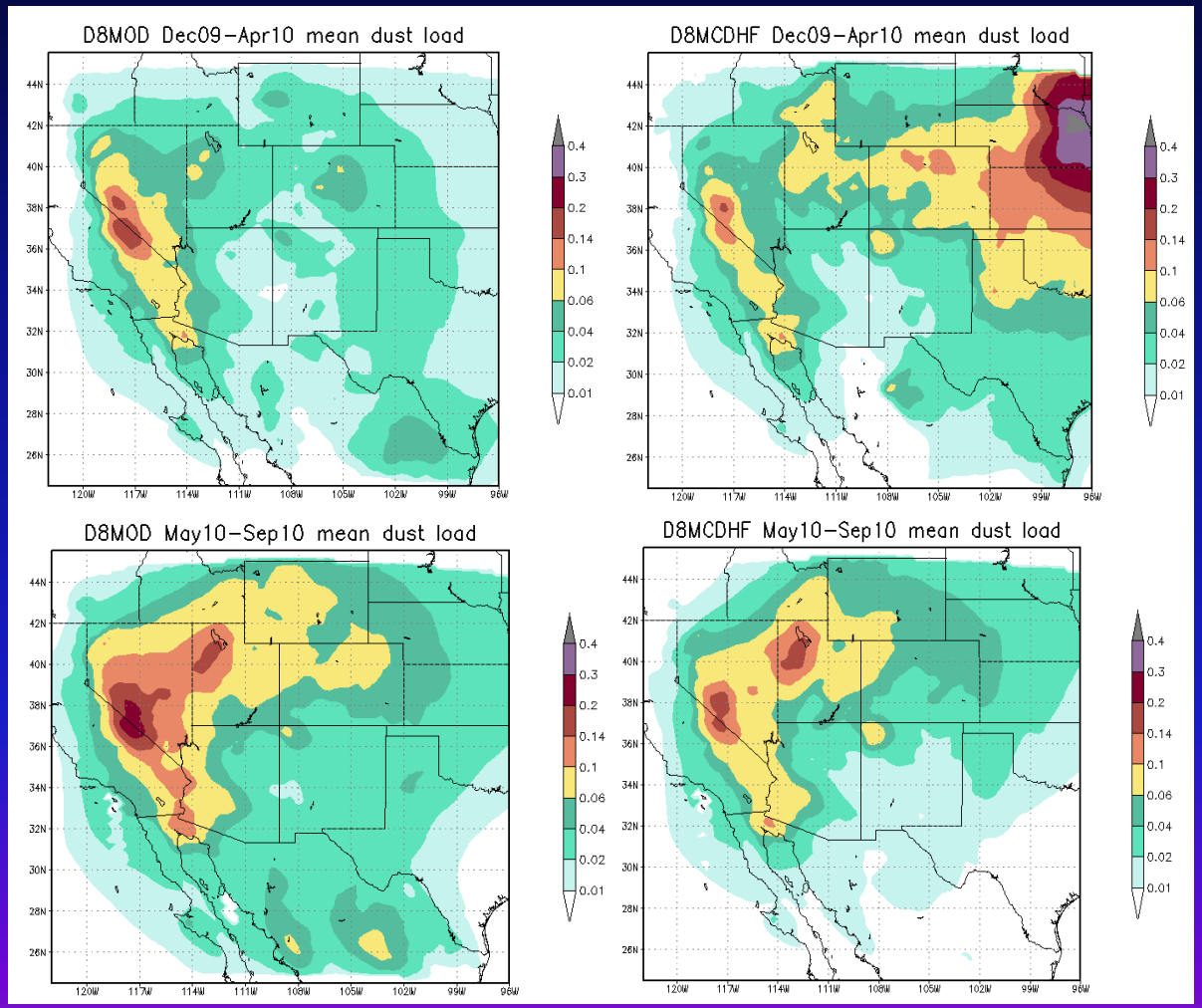
AERONET Stations



METAR Stations



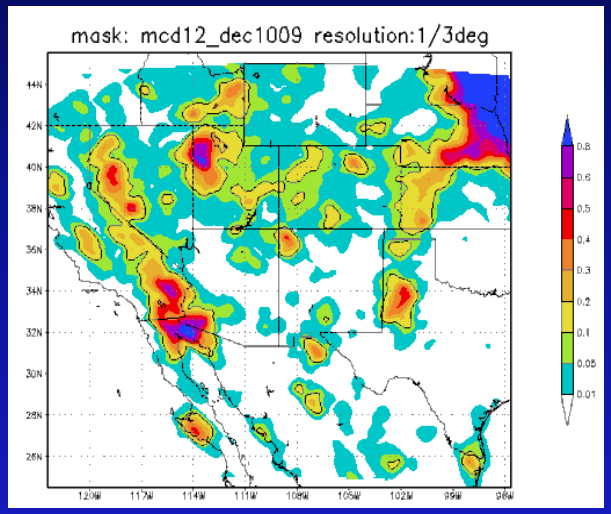
Comparison of MOD & MCD Mean Dust Loads for Dec09-Apr10 & May10-Sep10



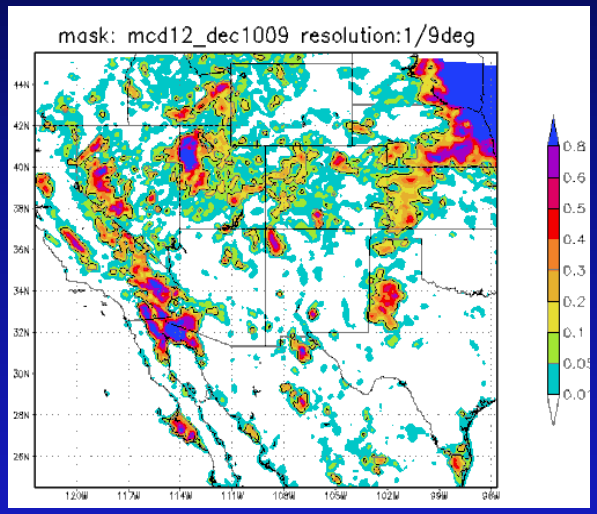
DREAM/eta
MOD17km, 8-bin (left)
MCD 7.5, 8-bin (right)

DREAM/eta
MOD17km, 8-bin (left)
MCD 7.5, 8-bin (right)

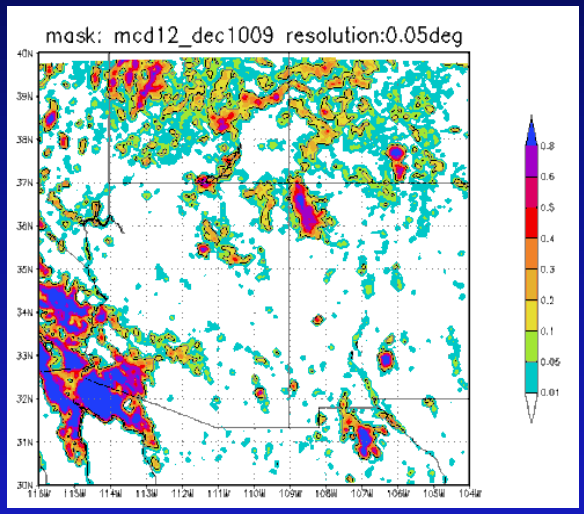
MCD-12 Dust Source Geography on 10Dec09 for 3 Model Resolutions



50km, 0.33° grid



17km, 0.11° grid



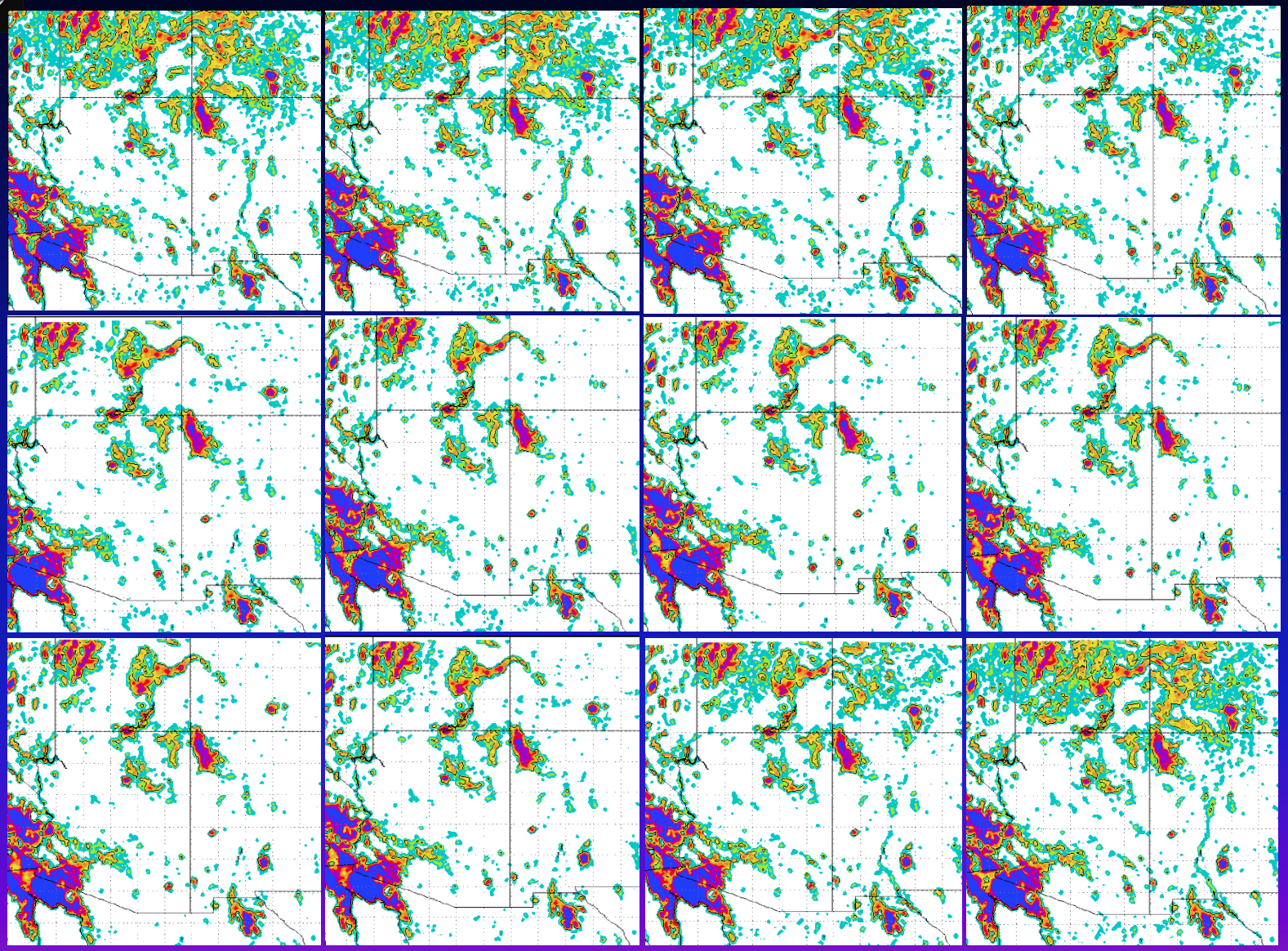
7.5km, 0.05° grid

Monthly Dust Source Geography, 2009

JFMA

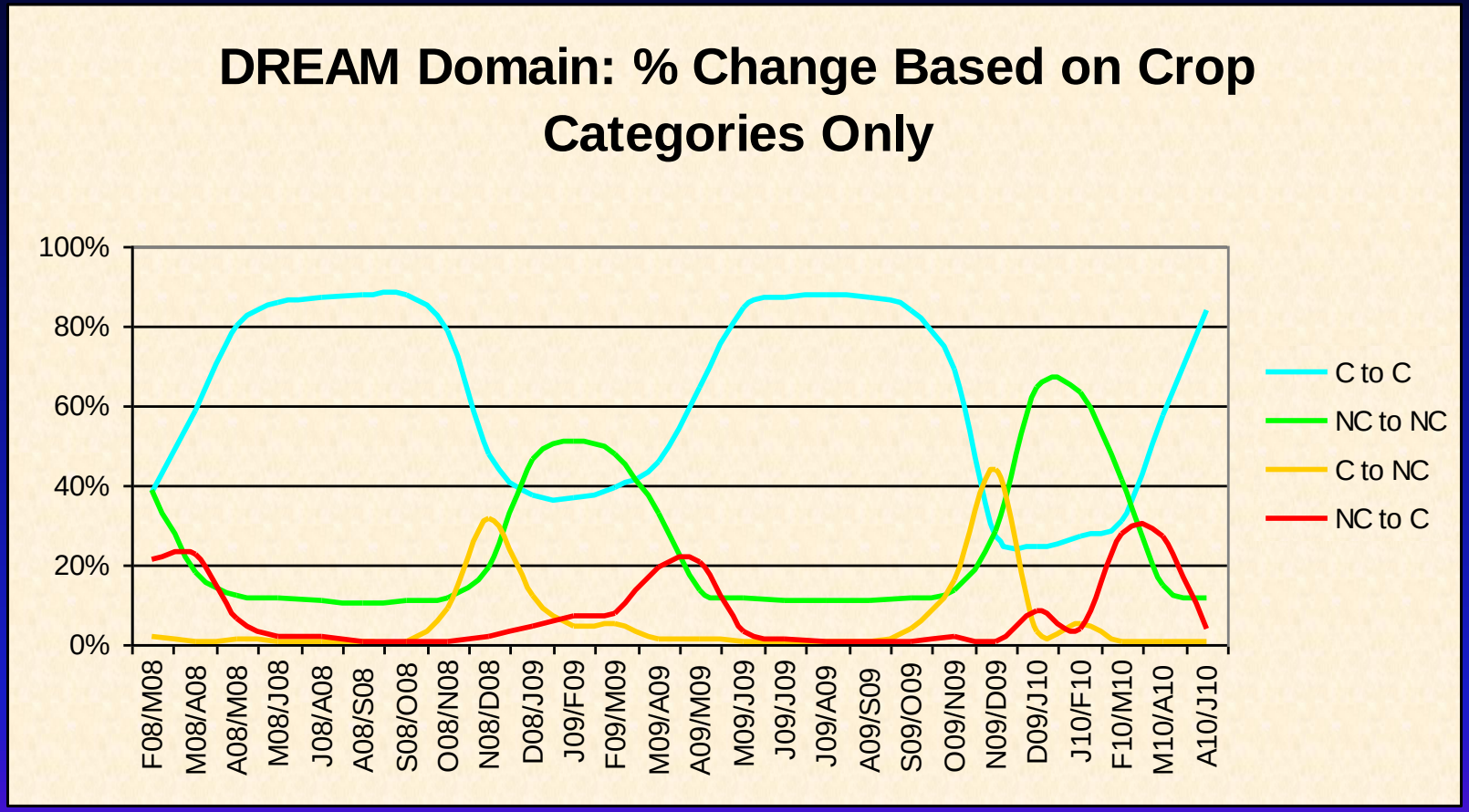
MJJA

SOND



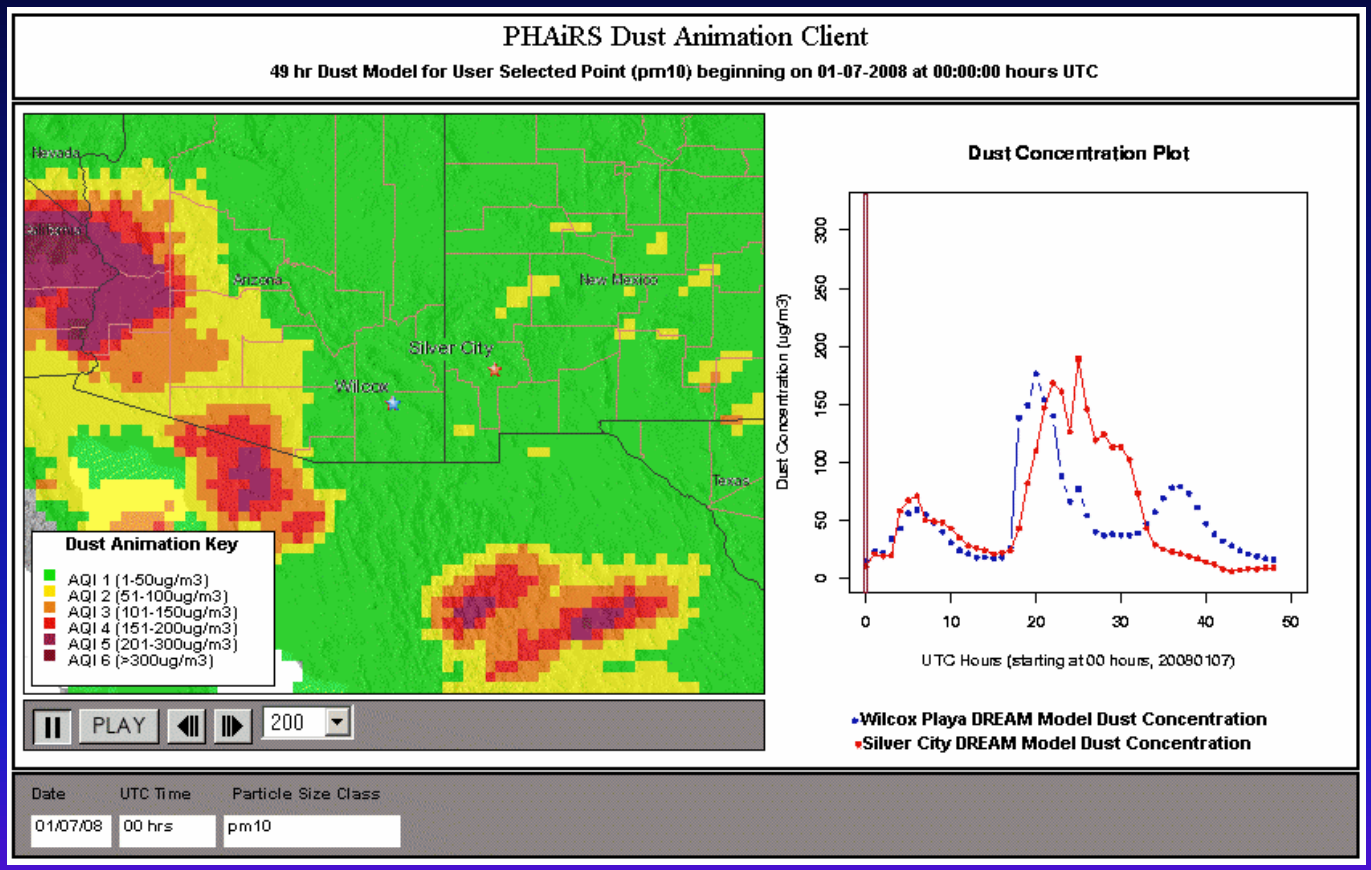
UNM EDAC CDC NEW MEXICO DEPARTMENT OF HEALTH NASA

Changes in Dust Sources in DREAM Domain Feb '08- Apr '10



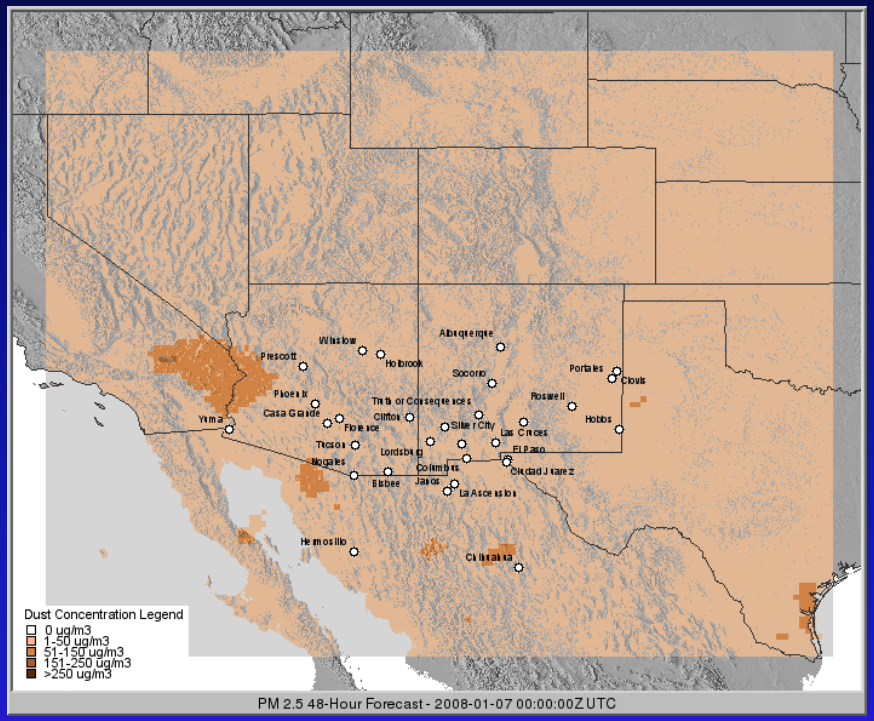
Every 2 weeks approximately 1% of the NDVI (1s & 0s) in each category change location in the model domain; but in cropped areas, higher percentages are observed that add to dust entrainment potential that can result in haboobs

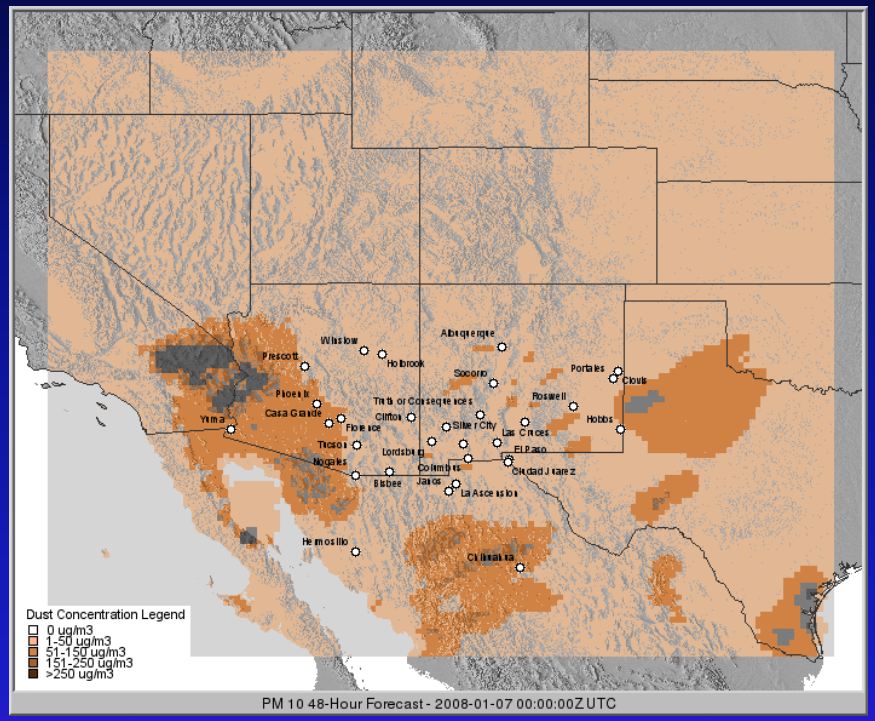
PHAiRS Dust Forecast Presentation



Revised Forecast Presentation

With volunteer observer network





Metadata Extract For Dust Masks

- FGDC-compliant metadata created & parsed for:
  - Dust masks
  - Concentrations of $PM_{2.5}$ modeled by DREAM/eta
  - AQI reclassification of $PM_{2.5}$
  - Daily averages of $PM_{2.5}$ by month

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New Mexico Environmental Public Health Tracking

NM Department of Health
Building a Healthy New Mexico

Home | Environmental Exposure | Health Effects | Data Query | About NM Tracking | Conditions and Alerts | Resources

ome » Data » Query

Environmental Exposures | Health Effects | Population and Geography | Compare Data

Metadata search:

Air Quality

Dust Forecasts

Vegetation

Water Quality

Dust Forecasts

Select a particle size:

DREAM PM 10 Dust Forecast

Select a date:

05/09/2011

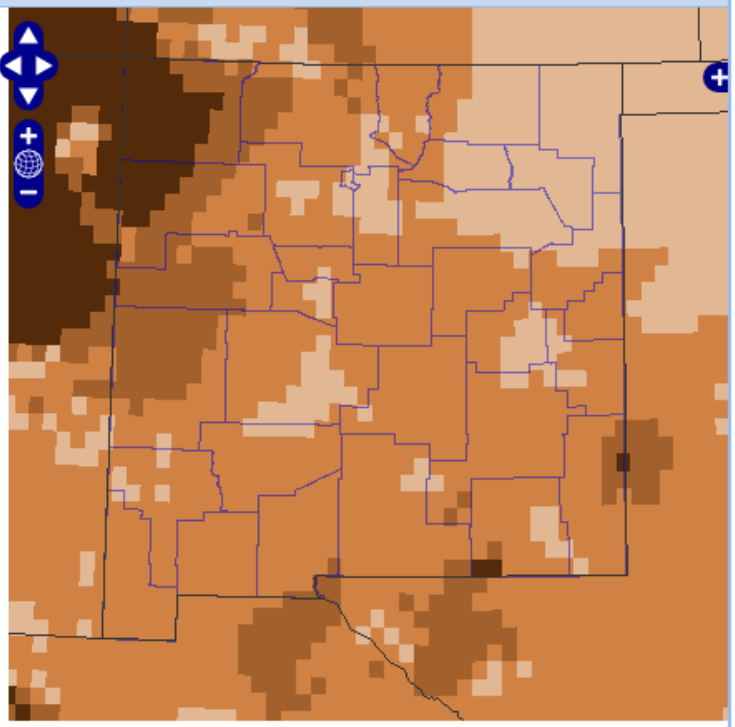
Select an hour:

14:00

Submit Query

Map | Metadata | Report

Environmental Exposures / Dust Forecasts / DREAM PM 10 Dust Forecast



Dust Concentration Key

- 0 ug/m3
- 1-50 ug/m3
- 51-150 ug/m3)
- 151-250 ug/m3
- > 250 ug/m3

Please change layers to s
the daily statistic forecast
instead of the default ho
concentration.

Done

Internet

100%

UNM EDAC CDC NEW MEXICO DEPARTMENT OF HEALTH NASA

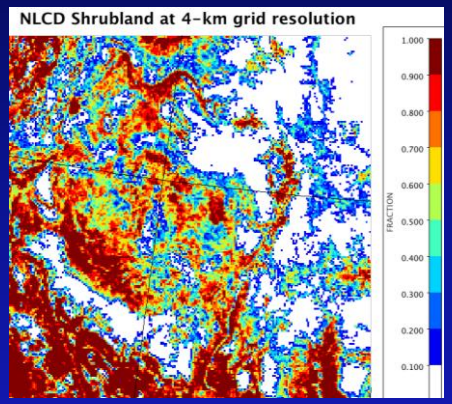
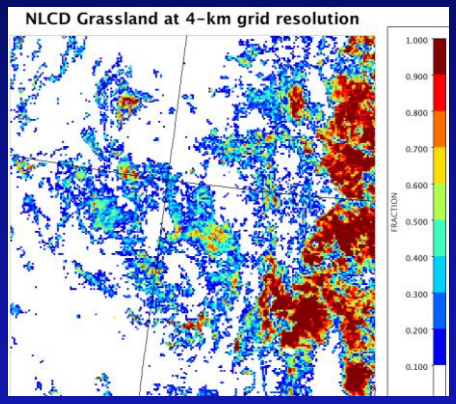
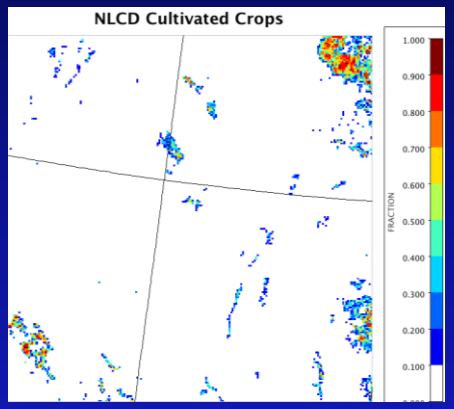
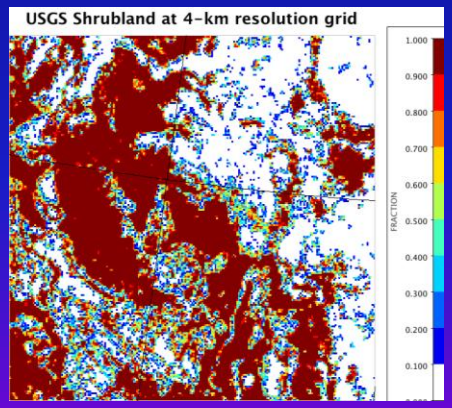
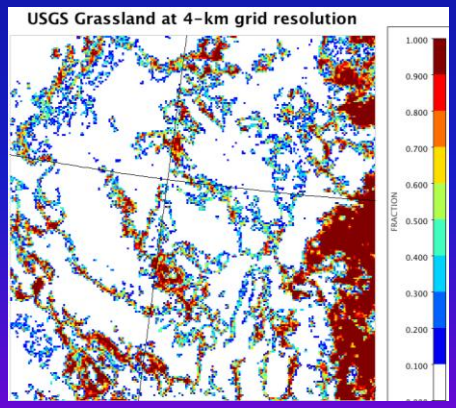
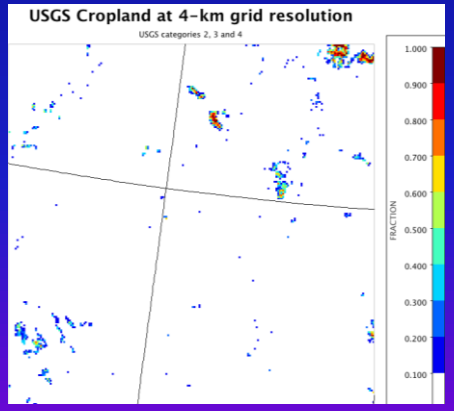
Daily PM10 Dust Statistics

Data Table: Daily Statistics

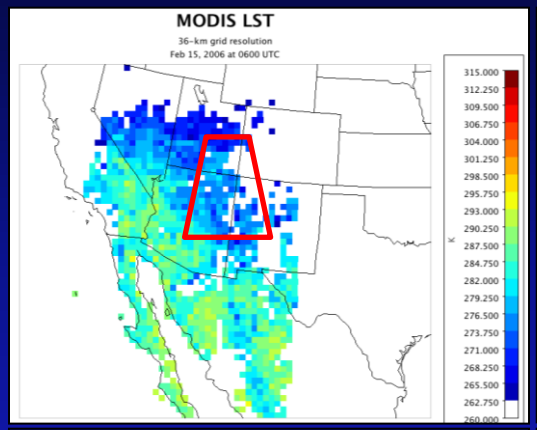
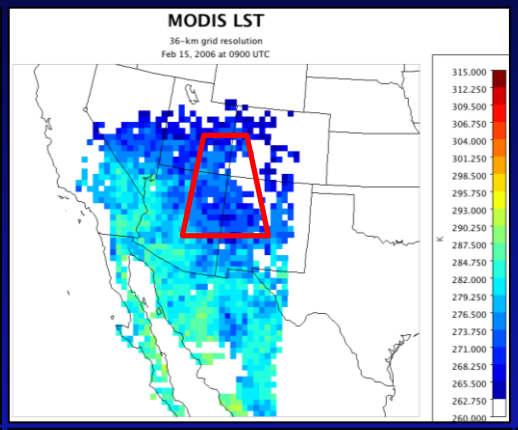
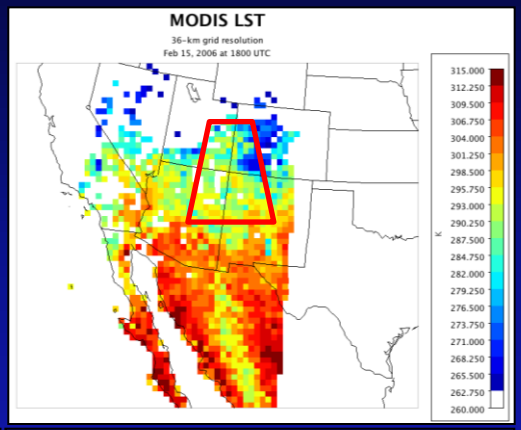
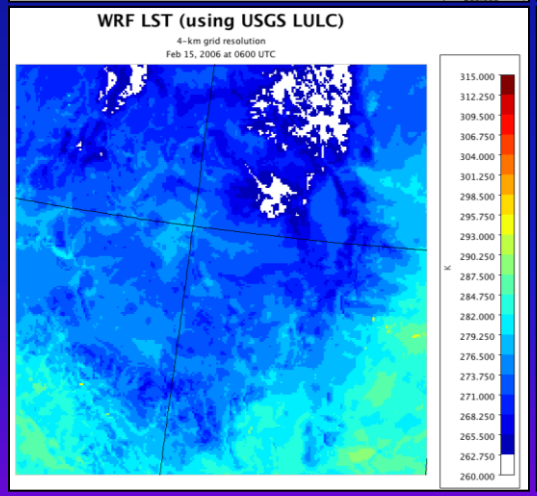
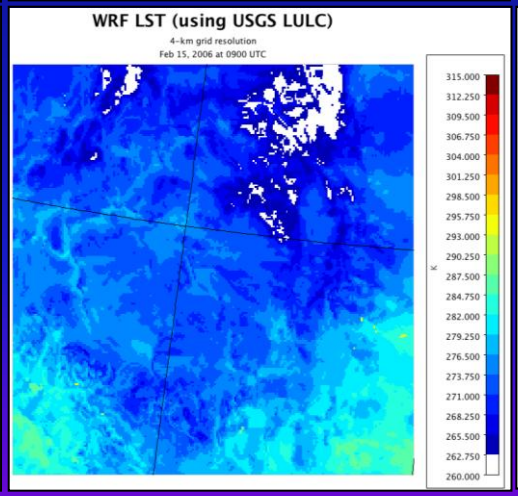
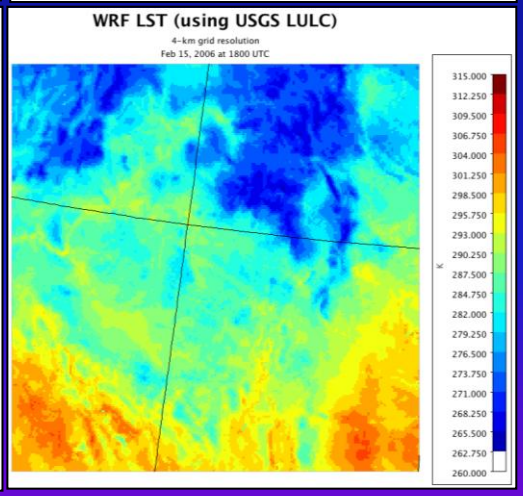
County	FIPS	Minimum	Maximum	Median	Mean
Bernalillo	35001	13	38	23.1458333333	23.1071428571
Bernalillo	35001	13	38	23.1458333333	23.1071428571
Catron	35003	1	95	32.75	32.884765625
Catron	35003	1	95	32.75	32.884765625
Chaves	35005	1	56	18.6666666667	18.7731481481
Chaves	35005	1	56	18.6666666667	18.7731481481
Cibola	35006	12	130	30.2083333333	33.7777777778
Cibola	35006	12	130	30.2083333333	33.7777777778

CMAQ Modeling

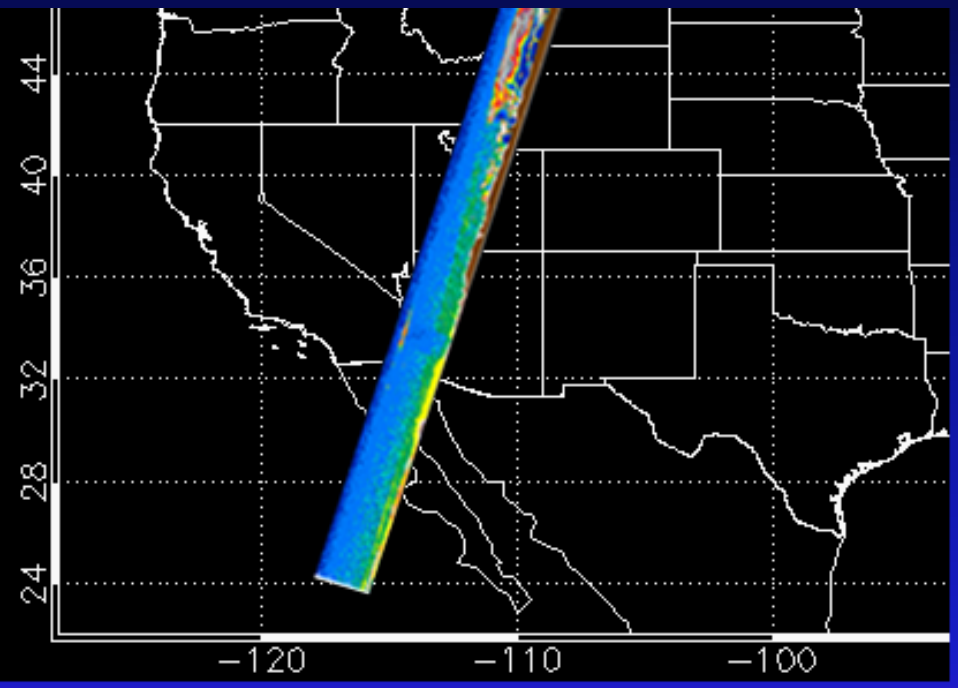
NLCD & USGS Fractional LU/LUC on a 4-km grid

	Shrub Land	Grass Land	Crop Land
NLCD			
USGS			

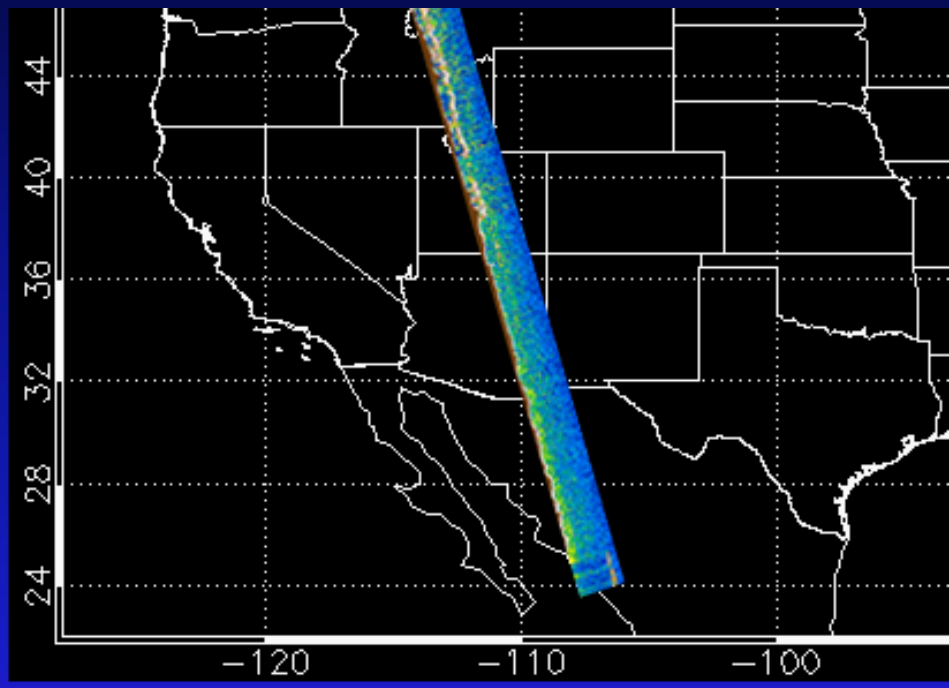
MODIS LST @36 Km & WRF LULC @ 4 KM on 15Feb2006

	0600 UTC	0900 UTC	1800 UTC
MODIS			
WRF			

CALIOP Curtains Are Infrequent Over The 3 Model Domains

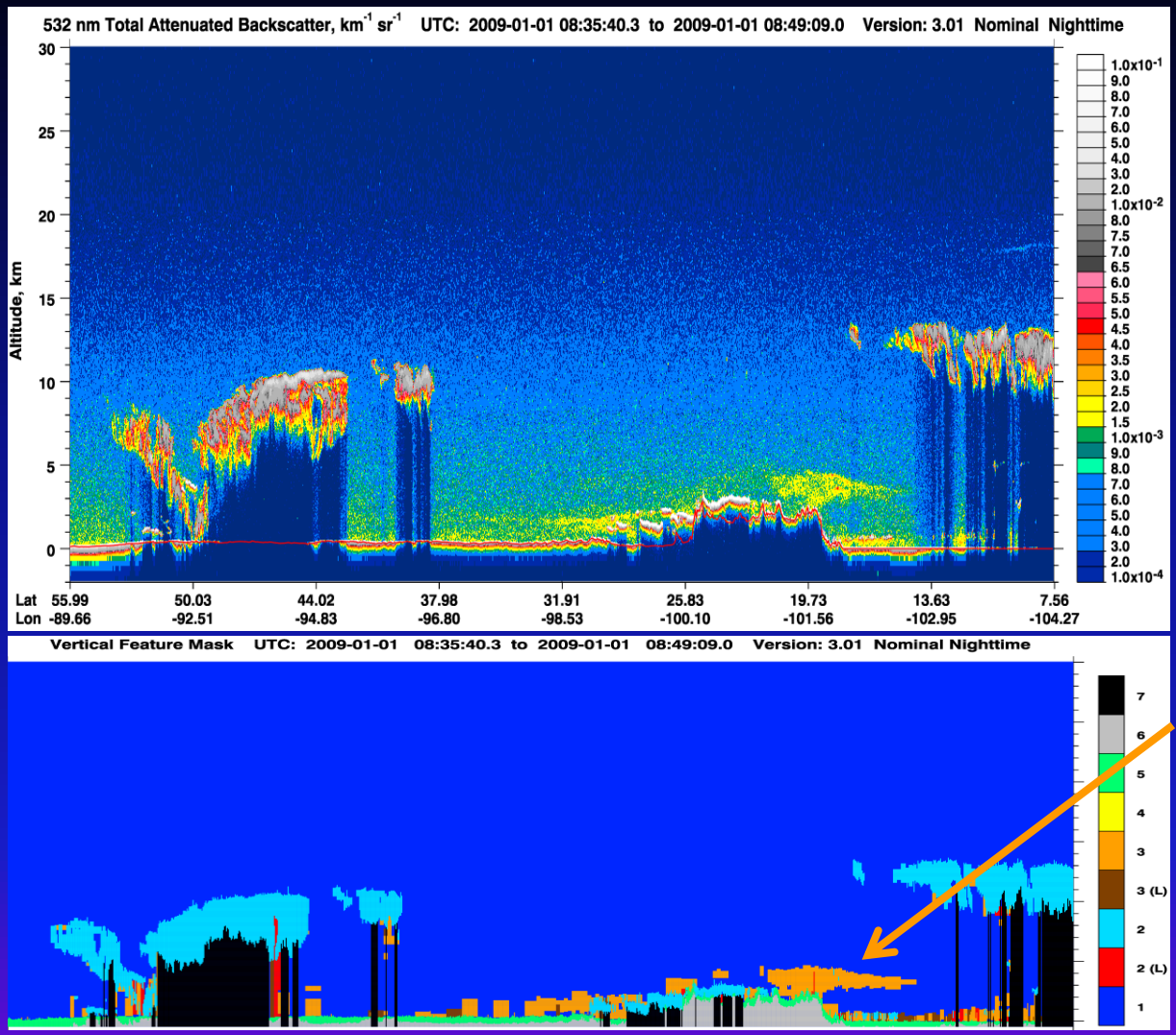


April 10, 2008 9:00 GMT



April 10, 2008 20:00 GMT

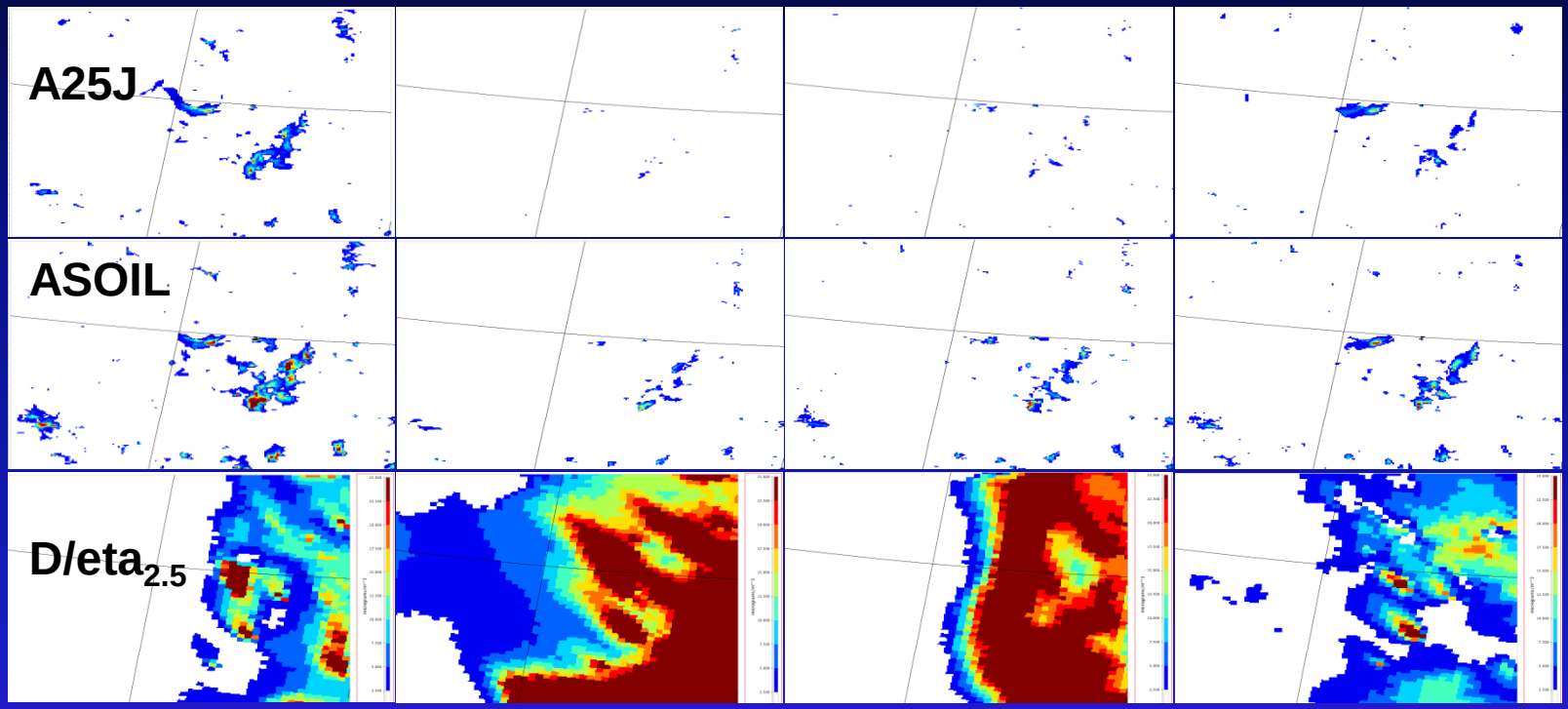
CALIOP: Another Dataset to Validate AOD



Note aerosol plume

Top: total attenuated backscatter at 532nm. Bottom: vertical feature mask permits separation of aerosols from clouds.

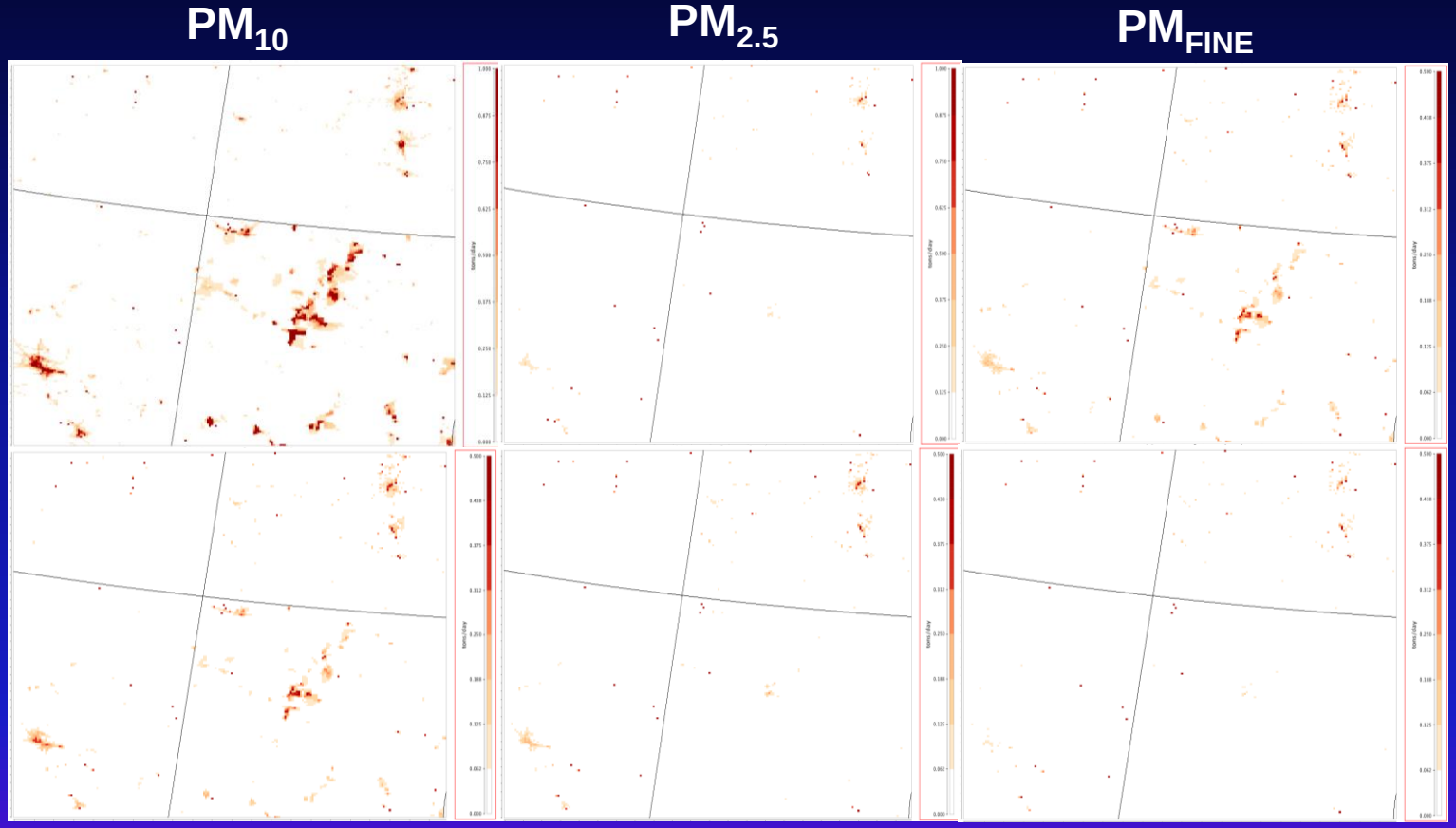
CMAQ concentration of A25J, ASOIL, & DREAM/eta $PM_{2.5}$ at 0:00 UTC, 15-18Feb06



A25J = accumulation mode unspecified anthropogenic mass;
ASOIL = coarse mode soil-derived mass; D/eta = modeled $PM_{2.5}$

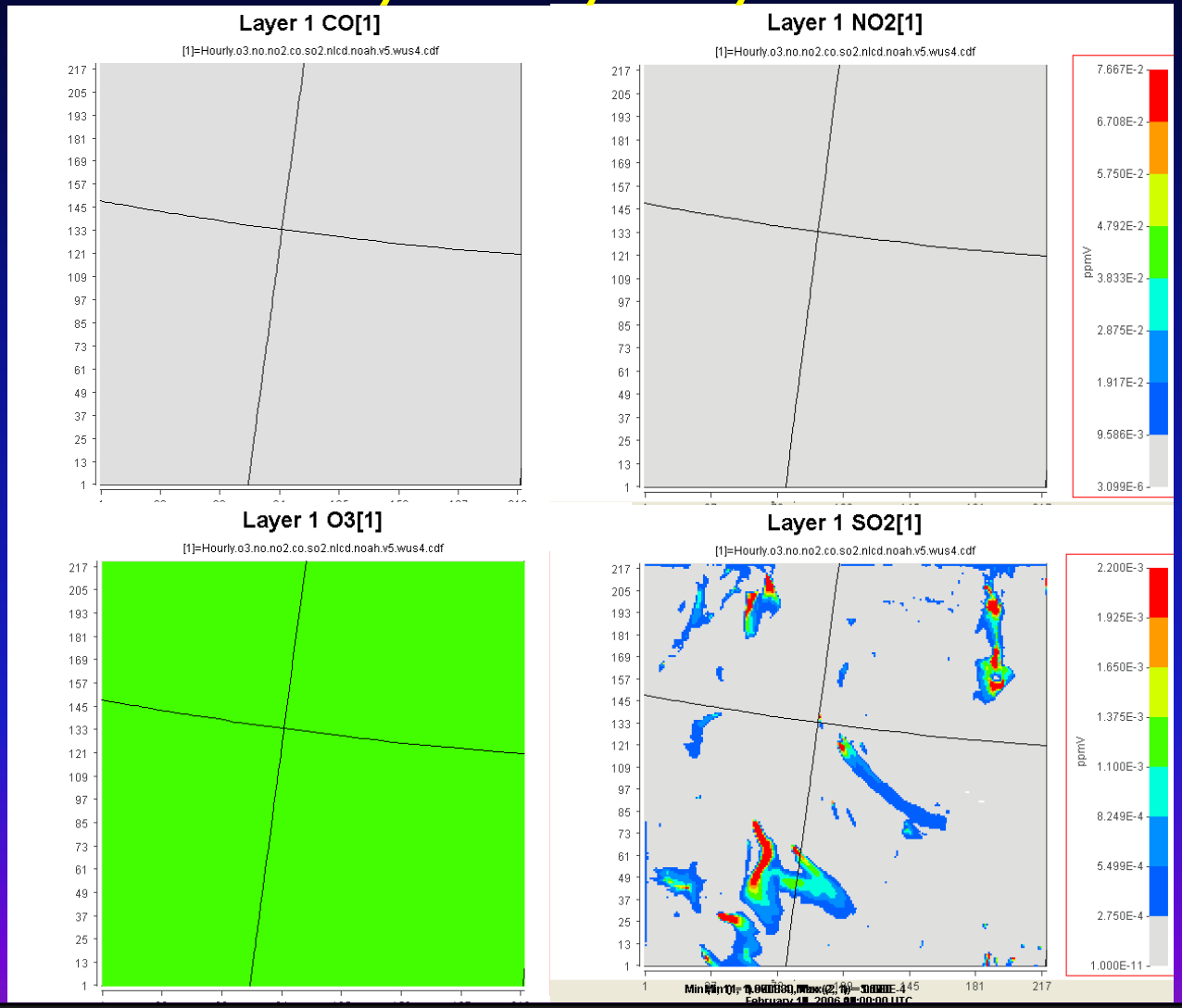
EPA's 2002 Emissions Inventory

Top row= daily average emissions including fugitive dust from source classification codes; Bottom row = fugitive dust subtracted

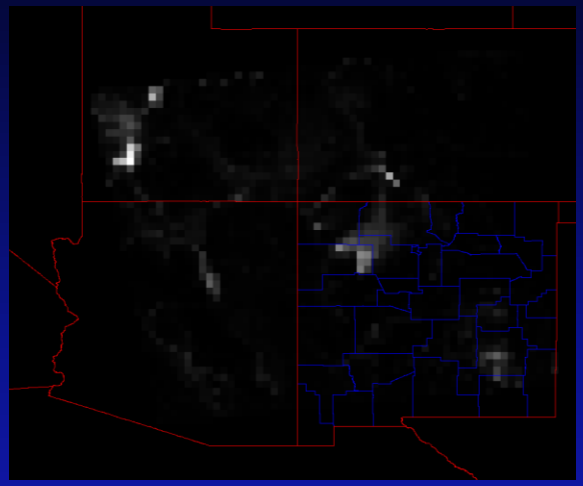


Simulating both windblown dust and anthropogenic air pollution events is intensive computationally in dusty regions. It is therefore desirable to evolve dust-only (e.g., DREAM/eta) and atmospheric dynamics-chemistry models

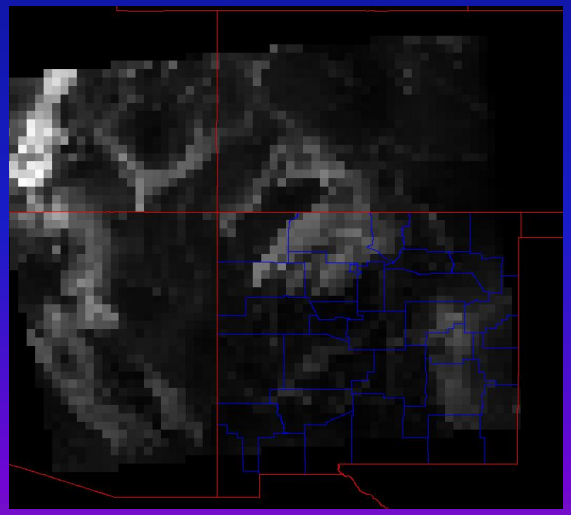
Ozone & Aerosol Animations for CO, NO2, O3, SO2

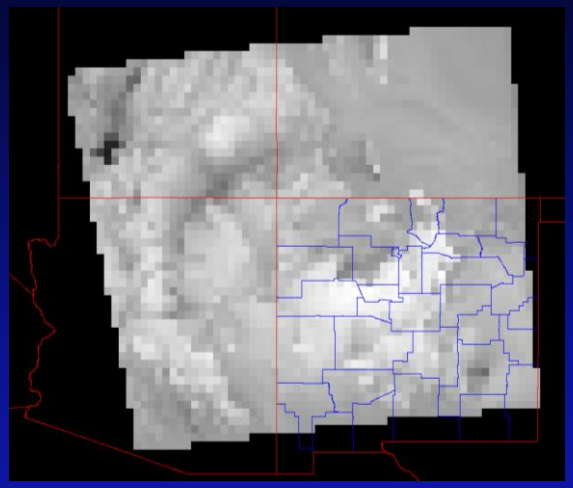


Geotiffs are the basis for Metadata Production



NO2 above; NO3 below



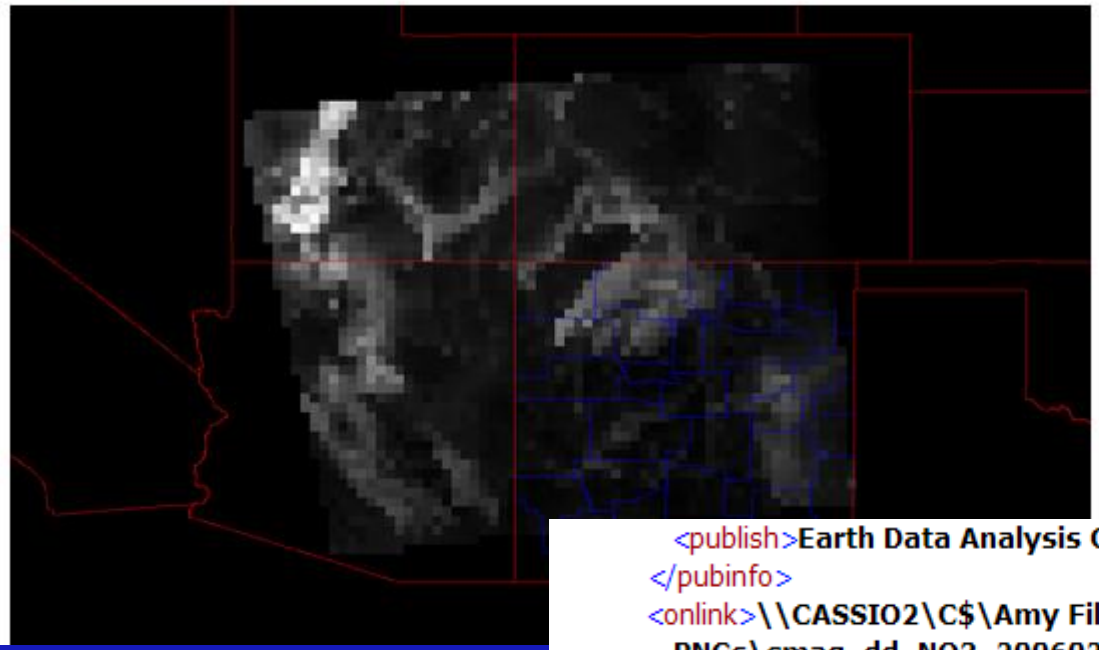


O3

CMAQ Geotiffs for 2/10/06. These rasters have been reprojected from Lambert Conformal to Geographic DD WGS84. The Geotiffs have metadata associated with them that can be read in Arc Software. The pixel values are all very small, and cannot be seen easily. Actual values are in the dataset. County boundaries are given for NM

Metadata Extract For NO_3

NO3 NO3.xml (15.3 KB)



CMAQ data are provided for 107 AQ contaminants. User selected

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      </pubinfo>
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    </citeinfo>
  </citation>
- <descript>
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      EPA's Community Multiscale Air Quality (CMAQ) model on a daily basis. This series
      concentrations in a 4km x 4km sub-domain for UT, CO, AZ, & NM (sometimes refer
      the USA).</abstract>
    <purpose>These data are develped to help understand the impact of atmospheric co
      human health.</purpose>
    <supplinf>These metadata describe one of the 107 air quality contaminants: NO3.</s
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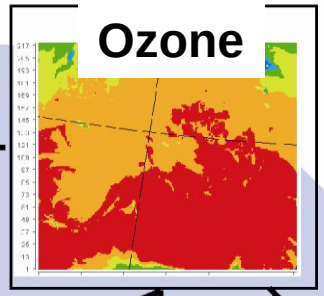
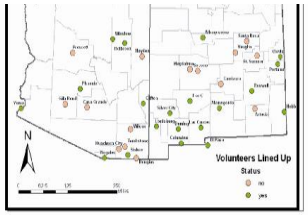
Integration Elements

AIRNow

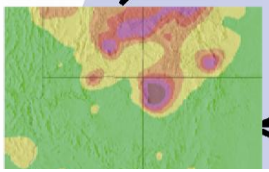
Ozone



Air Qual Observers



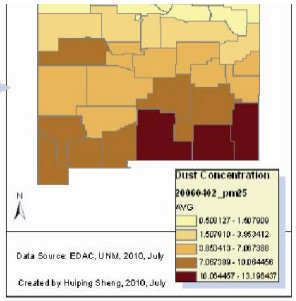
Hrly dust [ ]



Health data

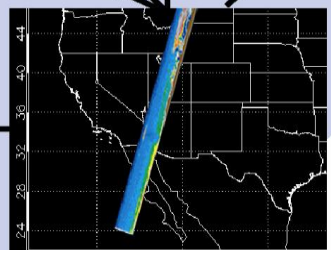
ER Visits
Asthma Stats
COPD Stats

Mthly avg dust [ ]



Metadata

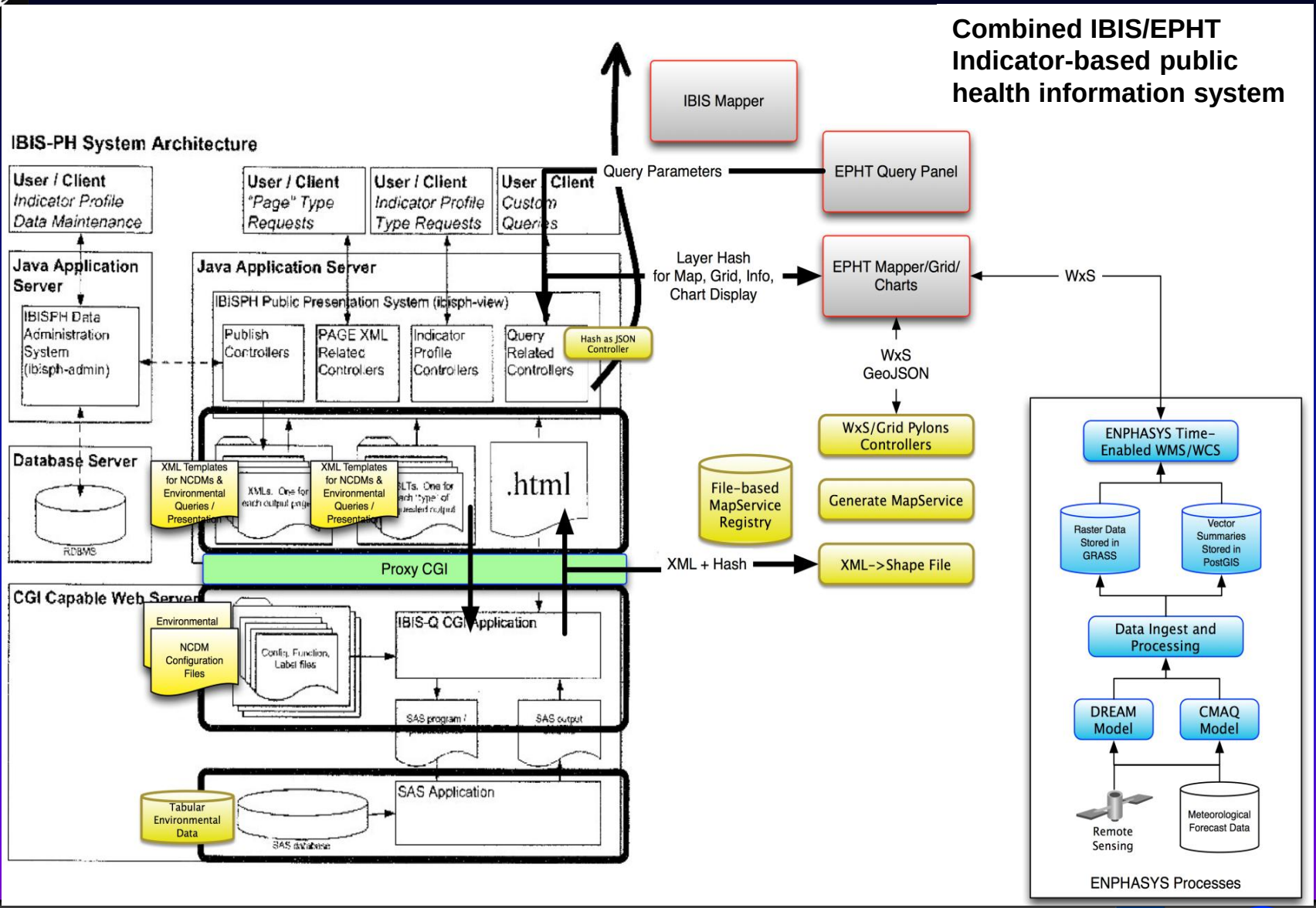
CALIOP Curtains



Data search & retrieval

Enhanced EPHTS/N Delivery & DSS

Combined IBIS/EPHT Indicator-based public health information system



Environmental Tracking for Public Health Surveillance

Introduction (Morain)
Part I – Biogeophysical Processes Impacting Human Health
Chapter 1 –Air Air Quality and Health (Elena Naumova, Dale Griffin)
Chapter 2 – Water Quality and Health (Philip Weinstein)
Chapter 3 – Soils and Health (Charles Rice)
Part II – Remote Sensing Applications
Chapter 4 –Waterborne Diseases (???????)
Chapter 5 –Land-based and Airborne Diseases (Fazlay Faruque)
Chapter 6 – Zoonotic & Vectorborne Diseases (Richard Kiang)
Chapter 7 – Emerging and Re-emerging Diseases (Clara Witt)
Part III – Integrating Earth Observing Technologies into Public Health
Chapter 8 – Data Discovery, Data Access & Retrieval (Steve Kempler)
Chapter 9 – Models and Modeling Techniques (Morain)
Chapter 10— Operational Environmental Monitoring-(David Green)
Chapter 11 – Semantic Approach to Environmental Search Capabilities (Taha Kas-Hout)
Chapter 12 – Decision Support Systems (William Hudspeth)
Chapter 13 – Early Warning Systems (Pietro Ceccato)
Chapter 14 –Health Microsystems and Environmental Macrosystems (Mark Lyles)

Savannah: Chapter A/E recruitment (material in-hand or forth-coming); San Antonio: Chapter contributions recruited (some received, some forth-coming); Santa Fe: gap fillers recruited. To publisher Mar'12 published Jul '12, or soon thereafter)

High-Level Outline
Final Benchmark Report

- Executive Summary
  - 1.0 Project Goals
  - 2.0 Enhancing EPHTS/N Tracking Systems
  - 3.0 Technology Transition
  - 4.0 CMAQ Modeling (O_3 and aerosols)
  - 5.0 CALIOP/AOD Validation Assessment
  - 6.0 DREAM/eta Modeling & Assessment
  - 7.0 References
- Attachments & Appendices

Project Team

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  - Goran Pejanovic
  - Ana Vukovic
  - Maudood Khan
  - Brian Barbaris
  - Patrick Shaw
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  - Amy Budge, Proj. Mgr.
  - Bill Hudspeth
  - Tom Budge
  - Karl Benedict
  - Hays Barrett
  - Matt Gagnon
  - Peggy Allison
  - Orrin Myers &, Huiping Sheng, UNM HSC